

Effect of Temperature on the Physical and  
Electrochemical Characteristics of  $V_2O_5$  Cathode  
Materials

P. H. Smith, M. L. Anderson, S. Dallek, and W. M. Baker  
Naval Surface Warfare Center  
Carderock Division  
9500 MacArthur Boulevard  
West Bethesda, MD 20817-5700

S. A. Weismann  
NSWC Science and Engineering Apprentice Program  
Walt Whitman High School  
7100 Whittier Boulevard  
Bethesda, MD 20817

Vanadium pentoxide ( $V_2O_5$ ) materials are being investigated for use as high energy-density cathodes in rechargeable lithium batteries. Our goal is to develop a cathode capable of delivering  $400 \text{ mAh g}^{-1}$ . One way to achieve high capacity cathode materials is to use a sol-gel preparation. Sol-gel techniques allow for the formation, at low temperatures, of amorphous or nanocrystalline materials with designed microstructures.

$V_2O_5$  gels were synthesized at various temperatures following a procedure similar to Dunn et al.<sup>1</sup> The gels were then subjected to either supercritical drying (forming aerogels) or ambient drying procedures (forming ambigels). Materials were characterized by BET surface area analysis, thermogravimetry, scanning electron microscope, and helium pycnometry.

Preliminary results revealed: 1) Not only do aerogels have a higher surface area but they also have a greater water content than ambigels, 2) There is a correlation between the temperature at which the gel is synthesized and its discharge capacity, and 3) There is a correlation between the temperature at which a cathode is dried and its discharge capacity. (Cathodes dried at  $200^\circ\text{C}$  yielded greater capacity than those dried at  $125^\circ\text{C}$ ). We will discuss in greater detail the effect of synthesis temperature and drying temperature on vanadium pentoxide's properties such as surface area, density, water content and also on its performance in an electrochemical cell ( $\text{Li}/V_2O_5$ ).

1. Chaput, F., Dunn, B., Fuqua, P. and Sallous, K., Journal of Non-Crystalline Solids 188 (1995) 11-18.